



# ecology and environment, inc.

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International Specialists in the Environment

St. Louis FMCO #2

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## MEMORANDUM

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OCT 19 1989

TO: Pete Culver, RPO

THRU: John Caoile, FITOM

FROM: John K. Cook, E & E/FIT

DATE: October 19, 1989

SUBJECT: Preliminary Assessment of the St. Louis Coal Gas site, St. Louis, Missouri.

TDD #F-07-8804-048

PAN #FM00681PA

Site #V12

Project #001

Superfund Contact: Greg Reesor

HAZARDOUS WASTE PROGRAM  
MISSOURI DEPARTMENT OF  
NATURAL RESOURCES

## INTRODUCTION

The Ecology and Environment, Inc., Field Investigation Team (E & E/FIT) was tasked by the Region VII U.S. EPA to conduct a preliminary assessment (PA) of the former St. Louis Coal Gas plant, in St. Louis, Missouri (Figure 1). The objective of this PA was to evaluate the environmental concerns posed by waste disposal practices at this facility. The potentially responsible party (PRP) is LaClede Gas. File information for the site is limited, and the PRP did not cooperate in providing historical documentation regarding past activities at the site. Therefore, much of the PA is based on the FIT's experience at other manufactured gas plants in Region VII, and investigative work conducted at such a site less than one mile north of St. Louis Coal Gas.

## SITE DESCRIPTION AND HISTORY

The St. Louis Coal Gas site, also known as the St. Louis Gas, Fuel, and Power Company, operated from 1888 to 1910 (Radian 1984). The facility was located at the intersection of 2nd and Convent streets, in an industrialized area of the city adjacent to the Mississippi River (Figure 1). The geographic coordinates for the site are 90° 11' 07.1" west longitude and 38° 36' 50.3" north latitude (USGS 1974). The site property is currently owned by Nooter Corporation, 1400 South 3rd St., St. Louis, Missouri, 63104. The facility utilized a water gas process to produce an average 60 million cubic feet of gas per year (Radian 1984).

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## WASTE CHARACTERISTICS

Manufactured gas plants produce numerous by-products including tar sludges, ammonia, light oil derivatives, and spent iron oxide catalyst. Of these, the two waste streams of primary concern are the tar sludges and the spent iron oxide wastes (E & E 1988). Coal tars are removed from the gas in the wash box and condenser. These wastes are primarily polynuclear aromatic hydrocarbons (PAHs) and phenolics produced during coal or coke combustion and during the oil injection process. Spent iron oxide wastes are produced during the gas purification process where impurities are removed from the manufactured gas by passing it through a bed of active hydrated iron oxide. The active hydrated iron oxide is usually carried on small wood chips or corncobs. The filter media can be reused until tar accumulation and reaction with cyanide, which produces ferrocyanides, causes it to lose activity. The spent oxide waste is usually blue-gray in color, due to the presence of ferrocyanide salts, and contains sulfur and cyanide compounds, and small quantities of coal tar. Light aromatics such as benzene, toluene, and xylene (volatile organic compounds) also are occasional constituents of coal tar wastes.

It is estimated that 730 gallons of tar waste was produced for every one million cubic feet of gas generated. Using this conversion factor, the St. Louis Coal Gas facility may have produced approximately 43, 800 gallons of tar waste per year, or 9,640,000 gallons over its 22-year operational history. Typically, 76 percent (7,326,400 gallons) of waste produced was sold as feedstock for other processes. Coal tar can be used as wood preservatives, road treatments, herbicides, or sold to coal tar refineries for further processing. The remaining 24 percent (2,313,600) is likely to have been disposed on site, probably in burial pits or holding tanks.

Some of the PAH compounds likely to be present in the tar wastes are carcinogenic and are listed as 40 CFR Part 302 hazardous substances. All PAHs can be considered as carcinogenic as benzo(a)pyrene, a class A carcinogen (EPA 1980). The carcinogenic potential of PAHs can be assessed through a determination of total PAH concentrations (summation of the concentrations of all PAHs detected in a given sample). Drinking water standards for PAHs are incomplete.

PAH and phenolic compounds may enter the atmosphere through volatilization. Once in this matrix, the materials may undergo molecular or advective diffusion. PAH compounds are likely to undergo dispersion when introduced into surface water. If this occurs, the contaminants are very susceptible to adsorption onto clay particles suspended in the water. Depending on the nature of the surface water, this material may also volatilize; thus entering the atmosphere. Once in the surface water the PAH compounds are prone to chemical alteration through biodegradation. PAHs in ground water are also likely to undergo dispersion and adsorption processes. Biodegradation of these materials is unlikely in this matrix (Koppers 1984). Phenolic compounds in ground water can be transported through dispersion. It is possible that these chemicals may undergo limited biodegradation in ground water environments (Koppers 1984).

In the soil matrix, PAHs can be involved in adsorption processes as well as biodegradation reactions. These materials may also undergo volatilization, leaching, and photolysis depending on site-specific characteristics. Phenolic compounds in the soil environment can be leached readily or removed through biodegradation (Koppers 1984).

PAH compounds are stable and tend to be retained in sediments. The specific stability of a particular PAH compound is dependent on its chemical structure (Koppers 1984). Generally the stability/solubility is inversely related to the molecular weight of the PAH. The arrangement of the benzene rings is also important. For example, anthracene is relatively soluble. It is a medium-mass PAH composed of three linear rings. The arrangement of the rings allows this relatively massive molecule to be soluble. Benzo(a)pyrene is composed of a single ring surrounded by benzene rings on four of its six sides. It is one of the more massive PAHs. This material is more stable than anthracene, the most soluble PAH. When the rings become arranged in a step-wise fashion, they are members of the most stable PAH group. An example of this is chrysene.

The migration of coal tar in ground water has been observed in several former coal gas manufacturing sites (E & E 1988). Many coal tar constituents are more dense than water and tends to migrate downward through porous material to a confining layer of less porous material. In areas where this behavior is exhibited the profile is as follows: ground water with dissolved organics; ground water with trapped coal tar; and, below the confining layer, ground water with dissolved organics.

#### SOILS AND STRATIGRAPHY

The soils in the area belong to the Harvester, Fishpot, and Urban Land associations, which are classified as fine loams to fine, silty, clay loams. On site, the soils belong to the Urban Land, bottomland unit. This unit consists of areas in which more than 85 percent of the surface is covered by asphalt, concrete, buildings, or other impervious material. The area originally was bottomland which has been built-up to protect the site from flooding. The amount of fill in the area can range from 0 to over 20 feet. Variability of the soils in the area makes identification impractical without a detailed on-site investigation (USDA 1979).

The specific stratigraphy beneath the site can be inferred from regional data. However, for more accurate information a more in depth, site specific geologic study would be required. The bedrock stratigraphy beneath the site belongs to the upper Mississippian and lower Pennsylvanian systems, which are roughly 286 to 360 million years old. These systems are subdivided, in descending order, into the Pleasanton, Marmaton, and Cherokee groups of the Pennsylvanian System, and the Mermacian series of the Mississippian System (MGS 1961).

The Mermacian Series contains the following formations: Warsaw, Salem, St. Louis, and Ste. Genevieve. The predominant rock type is a finely crystalline, sometimes fossiliferous limestone with some dolo-

mite. This series displays a typical cyclothemic succession (transgressive/regressive limestones with interbedded shales) though not necessarily a complete one. Chert is a very common accessory in the upper portions of the series (MGS 1961).

The overlying Pennsylvanian deposits are predominantly clastic in origin. However, numerous limestone, coal, and shale beds occur. The lower groups (Cherokee and Marmaton) have formal subdivisions while the Pleasanton consists of undifferentiated shales, siltstones, sandstones, coal, and, to a lesser degree, limestone (MGS 1961).

#### **HYDROGEOLOGY/WATER RESOURCES**

The city of St. Louis and the surrounding communities obtain their potable water supply from surface water intakes on the Missouri, Mississippi, and Meramac rivers. The intakes are about nine miles upstream from the site (USGS 1974). The combined flow from the Missouri and Mississippi rivers averages approximately  $1.12 \times 10^{10}$  gallons per day. The Meramac has an average flow of  $1.93 \times 10^9$  gallons per day. Because there is an abundance of potable surface water, ground water is not utilized as a source of drinking water. The bedrock aquifers for the region are divided into five discrete units:

- ° Group one, the Post-Maquoketa, includes the strata above the Kimmswick Formation to the surface. Below this aquifer group lies the Maquoketa shale, which acts as an aquitard.
- ° Group two is the Ordovician-age Kimmswick-Joachim aquifer. Near the top of this unit is the Decorah Formation, which probably acts as a confining bed composed of shales and interbedded limestones (MGWS 1961).
- ° The three remaining lower aquifers are separated primarily on the basis of unconformities. It is likely these aquifers groups, in descending order, the St. Peter-Everton, Powell-Gasconade, and the Eminence-Lamotte are hydraulically connected (MGS 1961).

Generally the bedrock aquifers of the region yield very small quantities of water, about 0 to 50 gallons per minute (gpm). The alluvial aquifers (Post-Maquoketa) completed along the Meramac, Mississippi, and Missouri rivers, can provide much larger quantities. For example, the Weldon Springs Ordnance Plant production well yields almost 2,000 gpm. Other large yield industrial wells may be located in the area.

#### **POTENTIAL MIGRATION AND RECEPTORS**

The primary migration pathway of concern is the ground water route. Investigations at similar facilities in Region VII proved that hazardous substances were leached to ground water, and may reach surface water features via the ground water/surface water interface. However, there is no known use of ground water in the area. If ground water use could be documented, then a potential target population could be estimated.

The site is separated from the Mississippi River by a levee. It is possible that a severe flood could inundate the site, causing a release of contaminants to the river. If buried wastes are present, burial trenches may have been excavated below the water table, creating a conduit for contaminant migration to ground water, and ultimately the river. There may be a naturally occurring exchange of ground water and surface water. Local ground water flow is toward the river. Because municipal surface water intakes are approximately nine miles upstream, recreational users, possible commercial fisheries, and industrial water intakes, would comprise the target population. No sensitive or endangered environments were identified.

Since the potential wastes present are likely to be buried, the potential for an air release or for direct contact is minimal. The potential for direct contact would increase dramatically if excavation activities were undertaken.

#### **SUMMARY**

The St. Louis Coal Gas facility operated from 1888 through 1910 at 2nd and Convent streets in St. Louis, Missouri. File information regarding past site activities is very limited, though from production rates FIT estimates that up to 2,313,600 gallons of tar waste may have been disposed unlined on site. A typical practice of other coal gas facilities operating during this time frame in Region VII was to bury wastes in on-site trenches. Wastes constituents of coal tars and iron oxide wastes are toxic and carcinogenic.

Potential targets include those exposed to ground water (potential industrial wells only) and those exposed to any potential surface water release of ground water (recreational users and possible commercial fisheries).

Attachments: Bibliography  
Figure 1: Site Location Map  
EPA PA Form 2070-12

## BIBLIOGRAPHY

- Ecology and Environment, Inc., June 1988, Preliminary Assessment, Mound Street Power Station, St. Louis, Missouri, TDD #F-07-8708-029.
- Kopper's Company, Environmental Research and Technologies, Inc., 1984, Handbook on Manufactured Gas Plant Sites, Volume I.
- Missouri Geological Survey and Water Resources, 1961, Stratigraphic Succession in Missouri, Volume XL.
- The Radian Corporation, August 1984, Survey of Tar Waste Disposal and Locations of Town Gas Producers. Contract #68-02-3137.
- U.S. Department of Agriculture, Soil Conservation Service, 1979, Soil Survey of St. Louis County, Missouri.
- U.S. Environmental Protection Agency, October 1980, Ambient Water Quality Criteria for Polynuclear Aromatic Hydrocarbons, EPA Document #PB81-117806.
- U.S. Geological Survey, 1974, Cahokia 7.5 Minute Topographic Map Quadrangle.

